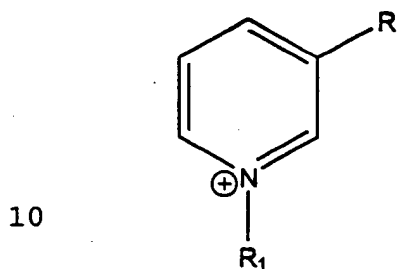
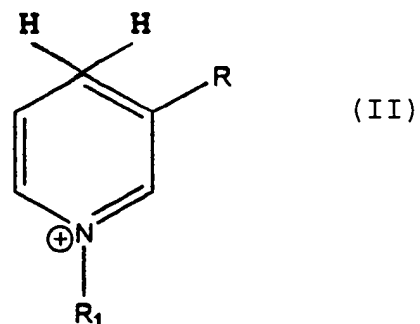


What is Claimed

1. A composition for replacement of  $\text{NAD(P)}^+/\text{NAD(P)H}$  in  
 oxido-reduction enzymatic reactions comprising a compound of  
 general formula I in a combination with its 1,4-reduced form  
 5 compound (II)

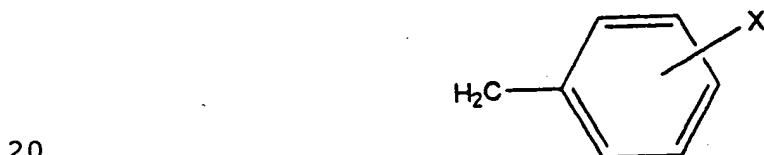


(I) and



wherein R is  $-\text{CN}$ ,  $-\text{C}(\text{O})\text{NH}_2$ ,  $-\text{C}(\text{O})\text{NHCH}_3$ ,  $-\text{C}(\text{S})\text{NH}_2$ ,  $-\text{C}(\text{O})\text{CH}_3$   
 15 or  $-\text{C}(\text{O})\text{OCH}_3$ ;

wherein  $\text{R}_1$  is  $-(\text{CH}_2(\text{CH}_2\text{O})_n \text{YR}_2)$ , ribose-Y- $\text{R}_2$  or



wherein Y is  $-\text{OPOO}-$ ,  $-\text{OBO}_2-$ ,  $-\text{OSO}_2-$ ,  $\text{CH}_3\text{NH}-$ ,  $-(\text{CH}_2)_n\text{NH}-$ ,  
 adenine, or imidazole;

$\text{R}_2$  is H,  $\text{CH}_3$ ,  $-(\text{OCH}_2\text{CH}_2)_n$ ,  $-(\text{NCH}_2\text{CH}_2)_n-$  or  $-[\text{N}=\text{P}(\text{OCH}_3)_2]_n$ ;  
 25 wherein X is  $-\text{OCH}_3$ ,  $-\text{CF}_3$ ,  $-\text{O}(\text{CH}_2\text{CH}_2\text{O})_n$  or  $-\text{OPOOR}_2$ ;

wherein  $\text{R}_3$  is H,  $-\text{CH}_3$ ,  $-(\text{OCH}_2\text{CH}_2)_n$ ,  $-(\text{NCH}_2\text{CH}_2)_n-$  or  
 $-[\text{N}=\text{P}(\text{OCH}_3)_2]_n$ ;

wherein n is 1-2000; chloride, bromide, sulphate,  
 phosphate, nitrate,  
 30 or a salt thereof.

2. The composition of claim 1 wherein the compound is  $\beta$ -nicotinamide-5-ribose methyl phosphate compound (6) and its reduced form is 1,4-dihydronicotinamide-5-ribose methyl phosphate compound (7).

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3. The composition of claim 2 wherein the compound in combination with its 1,4-reduced form is tethered to a polymer matrix.

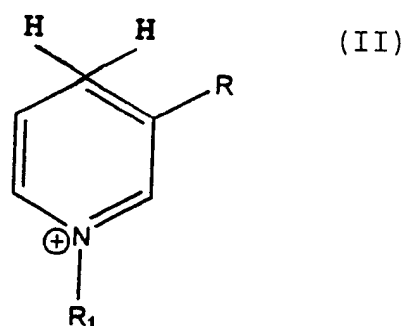
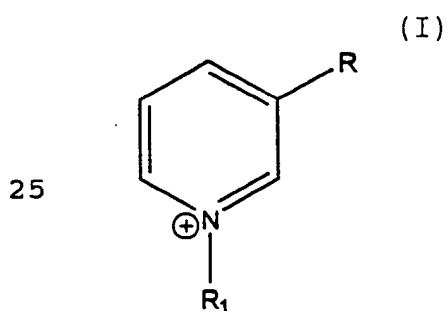
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4. A device for replacement or regeneration of  $\text{NAD(P)}^+/\text{NAD(P)H}$  system in oxido-reductive processes comprising

- a) a polymer matrix;
- b) a catalyst precursor;
- 15 c) a co-factor; and
- d) an enzyme.

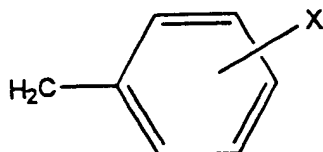
5. The device of claim 4 wherein the co-factor is  $\text{NAD}^+$ ,  $\text{NADP}^+$  or a biomimic compound of the formula I or II

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wherein R is  $-\text{CN}$ ,  $-\text{C}(\text{O})\text{NH}_2$ ,  $-\text{C}(\text{O})\text{NHCH}_3$ ,  $-\text{C}(\text{S})\text{NH}_2$ ,  $-\text{C}(\text{O})\text{CH}_3$  or  $-\text{C}(\text{O})\text{OCH}_3$ ;

wherein  $R_1$  is  $-(CH_2(CH_2O)_n YR_2, \text{ribose-Y-R}_2,$   
or



wherein Y is  $-OPOO-$ ,  $-OBO_2-$ ,  $-OSO_2-$ ,  $CH_3NH-$ ,  $-(CH_2)_nNH-$ , adenine, or imidazole;

10  $R_2$  is H,  $CH_3$ ,  $-(OCH_2CH_2)_n$ ,  $-(NCH_2CH_2)_n-$  or  $-[N=P(OCH_3)_2]_n$ ;

wherein X is  $-OCH_3$ ,  $-CF_3$ ,  $-O(CH_2CH_2O)_n$  or  $-OPOOR_2$ ;

wherein  $R_3$  is H,  $-CH_3$ ,  $-(OCH_2CH_2)_n$ ,  $-(NCH_2CH_2)_n-$  or  $-[N=P(OCH_3)_2]_n$ ;

wherein n is 1-2000; or a salt thereof.

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6. The device of claim 5 wherein the co-factor is the biomimic used for replacement of  $NAD(P)^+/NAD(P)H$  system.

20 7. The device of claim 6 wherein the biomimic is in combination with its 1,4 reduced derivative.

8. The device of claim 7 wherein the catalyst precursor is rhodium, zinc, nickel, cobalt, iridium or ruthenium comprising complex.

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9. The device of claim 8 where the catalyst precursor is rhodium comprising complex.

30 10. The device of claim 9 wherein the catalyst precursor is  $[Cp^*Rh(bpy)(H_2O)]$  triflate salt.

11. The device of claim 8 additionally comprising a reducing agent.

12. The device of claim 11 wherein the reducing agent is formate, hydrogen, sodium borohydride, hydroquinone, sodium borohydrate, and electrode or a photon.

13. The device of claim 14 wherein the enzyme is oxidase or reductase.

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14. A method for replacement of  $\text{NAD(P)}^+/\text{NAD(P)H}$  in oxido-reduction enzymatic reactions comprising a step of replacing  $\text{NAD(P)}^+/\text{NAD(P)H}$  co-factors with a biomimetic composition of claim 1.

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15. The method of claim 14 comprising a step of reacting a substrate in the presence of oxidase or reductase and the composition comprising an oxidized and reduced form of the biomimic.

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16. The method of claim 15 further comprising a catalyst precursor providing a hydrid.

17. The method of claim 16 wherein the catalyst is  $[\text{Cp}^*\text{Rh}(\text{bpy})(\text{H}_2\text{O})]$  triflate salt.

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18. A catalyst precursor comprising rhodium, iridium, zinc, cobalt, nickel or ruthenium.